CLAIMS

What is claimed is:

1. A system for three-dimensional imaging comprising:

a first light source producing a first output including two or more pulses;

means for directing said first output to a target;

receiving means operable to receive a portion of said first output reflected from said target through atmospheric turbulence;

a first image sensor operable to produce two or more two-dimensional image slices of said target;

a second image sensor operable to detect two or more second sensor images of said target;

means for multiframe blind deconvolution operable to determine a point spread function from said two or more second sensor images;

means for deconvolution operable to deconvolve said point spread function from said two or more two-dimensional image slices and to produce two or more deblurred two-dimensional image slices; and

means for combining said deblurred two-dimensional image slices operable to form a three-dimensional image of said target.

2. The system of Claim 1, further comprising light from a second light source reflected from said target, wherein said receiving means is operable to receive said light from said second sensor, and wherein said second image sensor is operable to detect said two or more second sensor images from said light from said second light source.

3. The system of Claim 2, wherein said second light source is selected from the group consisting of a laser, the sun, multiple lasers, and self-emission form the target.

4. The system of Claim 3, wherein said second light source is a quasi-coherent or temporally

incoherent laser.

5. The system of Claim 1, wherein said means for multiframe blind deconvolution comprise a computer readable medium having instructions thereon to perform a step of estimating a point spread function from a second sensor image.

6. The system of Claim 1, wherein said means for deconvolution comprise a computer readable medium having instructions thereon to perform a step of deconvolving said point spread function from said two-dimensional image slices to produce deblurred two-dimensional image slices.

7. The system of Claim 1, wherein said means for combining comprise a computer readable medium having instructions thereon to perform steps of combining said deblurred two-dimensional image slices and forming a three-dimensional image of said target.

8. The system of Claim 1, wherein said means for directing comprise a laser beam director.

9. The system of Claim 1, wherein said first light source comprises a laser having an active medium made of Cr:LiSAF or Nd:YAG.

10. The system of Claim 1, wherein each of said two or more pulses has a fluence of about 0.1 to about 100 Joules per pulse.

11. The system of Claim 1, wherein each of said two or more pulses has a pulse width of less than 5 nanoseconds.

12. The system of Claim 11, wherein said pulse width is between about 0.1 to about 2 nanoseconds.

13. The system of Claim 1, further comprising means for compression operable to receive, compress, and transmit said two or more pulses.

14. A method for creating a three-dimensional image of a target through atmospheric turbulence, comprising the steps of:

directing a first output of pulses from a first laser to a target;

receiving reflected pulses from said target through atmospheric turbulence;

forming two or more two-dimensional image slices from a first image sensor;

forming one or more second sensor images of said target at a second image sensor;

performing multiframe blind deconvolution on said one or more second sensor images;

determining a point spread function from said one or more second sensor images;

deconvolving said point spread function from each of said two or more two-dimensional image slices;

forming a deblurred two-dimensional image slices from each of said two or more two dimensional image slices; and

combining said deblurred two-dimensional image slices to form a three-dimensional image of said target.

15. The method of Claim 14, further comprising storing said two or more two-dimensional image slices.

16. The method of Claim 15, wherein said step of storing said two or more two-dimensional image slices comprises storing said two-dimensional image slices in a first image sensor.

17. The method of Claim 14, further comprising receiving sunlight reflected from said target through said atmospheric turbulence.

18. The method of Claim 14, further comprising directing a second output of pulses from a second laser to said target.

19. The method of Claim 14, wherein said step of performing multiframe blind deconvolution further comprises incorporating *a priori* knowledge of a point spread function or of said target.

20. The method of Claim 19, wherein said step of incorporating *a priori* knowledge comprises

incorporating positivity constraints.

21. The method of Claim 14, further comprising calculating a maximum likelihood of a noise function.

22. The method of Claim 14, further comprising calculating one or more gradients of a noiseless image of said target.

23. The method of Claim 14, further comprising calculating a noiseless image of said target.

24. The method of Claim 19, wherein said step of incorporating *a priori* knowledge comprises incorporating an object pixel density function.

25. The method of Claim 21, further comprising using a sieve or small smoothing kernel.

26. The method of Claim 14, wherein said step of deconvolving said point spread function from each of said two-dimensional image slices further comprises using a guard band.

27. A method of forming a three-dimensional image of an object comprising the steps of:

determining a point spread function from an image from an incoherent or quasi-coherent light source; and

deconvolving two or more two-dimensional image slices formed from coherent or quasi-coherent light using said point spread function, to form deblurred image slices; and

combining said deblurred image slices to form a three-dimensional image of an object.

28. A three-dimensional imaging system comprising:

a point spread function calculated from an image formed from an incoherent or quasi-coherent light source; and

a three-dimensional image including two or more two-dimensional image slices formed from a coherent or quasi-coherent light source, wherein said two-dimensional image slices are deblurred by said point spread function.

29. The three-dimensional imaging system of Claim 28, further comprising processing means operable to calculate said point spread function.

30. The three-dimensional imaging system of Claim 29, wherein said processing means includes means for multiframe blind deconvolution operable to determine said point spread function.

31. The three-dimensional imaging system of Claim 29, wherein said processing means includes means for deconvolution operable to deconvolve said two-dimensional image slices using said point spread function.

32. The three-dimensional imaging system of Claim 29, wherein said processing means includes means for combining said two-dimensional image slices.

33. The three-dimensional imaging system of Claim 28, further comprising an incoherent light source.

34. The three-dimensional imaging system of Claim 28, further comprising a coherent light source.

35. The three-dimensional imaging system of Claim 28, further comprising a first image sensor operable to produce two or more two-dimensional image slices.

36. The three-dimensional imaging system of Claim 28, further comprising a second image sensor.

37. The three-dimensional imaging system of Claim 35, wherein said first image sensor is a time of arrival image sensor operable to produce said two-dimensional image slices.